



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/802,342	03/09/2001	David C. Ferranti	F084	7432

25784 7590 02/13/2003

MICHAEL O. SCHEINBERG
P.O. BOX 164140
AUSTIN, TX 78716-4140

EXAMINER

MCDONALD, RODNEY GLENN

ART UNIT	PAPER NUMBER
----------	--------------

1753

DATE MAILED: 02/13/2003

3

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.
09/802,342

Applicant(s)
Ferranti et al.

Examiner
Rodney McDonald

Art Unit
1753



-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extension of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on _____
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-23 is/are pending in the application.
- 4a) Of the above, claim(s) 12 and 20-23 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-11 and 13-19 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
*See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s). 2
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

Art Unit: 1753

DETAILED ACTION

Election/Restriction

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:
 - I. Claims 1-11 and 13-19, drawn to a method, classified in class 204, subclass 192.34.
 - II. Claims 12 and 20, drawn to a computer readable medium, classified in class 360, subclass 1+.
 - III. Claims 21-23, drawn to an apparatus, classified in class 204, subclass 298.34.
2. The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP. § 806.05(e)). In this case the process as claimed can be practiced by another apparatus such as manually controlling etching.
3. Inventions I and III are related as apparatus and product made. The inventions in this relationship are distinct if either or both of the following can be shown: (1) that the apparatus as claimed is not an obvious apparatus for making the product and the apparatus can be used for making a different product or (2) that the product as claimed can be made by another and materially different apparatus (MPEP. § 806.05(g)). In this case the apparatus can be used for etching a hole and not for repairing a defect.

Art Unit: 1753

4. Inventions II and III are related as combination and subcombination. Inventions in this relationship are distinct if it can be shown that (1) the combination as claimed does not require the particulars of the subcombination as claimed for patentability, and (2) that the subcombination has utility by itself or in other combinations (MPEP. § 806.05(c)). In the instant case, the combination as claimed does not require the particulars of the subcombination as claimed because the apparatus for ion milling does not require a computer readable medium. The subcombination has separate utility such as utilizing the computer readable medium in a simulation.

5. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

6. During a telephone conversation with Michael Scheinberg on February 11, 2003 a provisional election was made with traverse to prosecute the invention of Group I, claims 1-11 and 13-19. Affirmation of this election must be made by applicant in replying to this Office action. Claims 12 and 20-23 withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

7. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(I).

Art Unit: 1753

Claim Rejections - 35 USC § 112

8. Claims 1-11 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1, line 4, "location" should be "locations".

Claim Rejections - 35 USC § 102

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless -

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

10. Claim 13 is rejected under 35 U.S.C. 102(b) as being anticipated by Nakagawa et al. (U.S. Pat. 4,874,460).

Nakagawa et al. teach an apparatus for modifying a patterned film, composed of an ion source for producing an ion beam which is focused and caused to impinge upon a sample to microscopically machine a small region upon the surface of the sample; scanning electrodes and a scanning control circuit for scanning the focused ion beam; a detector that detect the secondary charged particles emanating from the sample in response to the irradiation; and a display device for displaying the pattern formed upon the sample according to the output from the detector. The apparatus further includes a nozzle for spraying etching gas against only a certain portion of the pattern when the focused ion beam is caused to fall upon the certain portion of the pattern, the

Art Unit: 1753

gas being activated by the ion beam that irradiates and scans the sample is not permitted to move from one spot to a neighboring spot until a given period of time elapses. Thus, a desired portion of the patterned film is rapidly and cleanly removed while minimizing the amount of the etching gas admitted into the apparatus. (See Abstract)

In operation of the above-described structure, a desired portion of a patterned film is repeatedly scanned with the focused ion beam. The film on this portion is gradually etched away by sputtering. The etching gas which is activated by the ion beam and can chemically etch the material of the patterned film is sprayed against the desired portion. Therefore, the desired portion is rapidly removed. (Column 3 lines 45-52)

An embodiment of the invention is hereinafter described with reference to the drawings. FIG. 1 shows a patterned film-modifying apparatus according to the invention. An ion source 1 generates an ion beam which is extracted by pullout electrodes (not shown). The beam is then focused to a submicron diameter by an ion lens system composed of condenser lenses 2 and objective lenses 3. The focused beam 5 is caused to impinge on the surface of a sample 6. Scanning electrodes 4 are disposed along the irradiating ion beam 6 so that it may be focused onto the sample and scan it. The scanning electrodes 4 are controlled by a scanning control circuit 16 which controls the scan made by the beam 5. The sample 6 is placed on XY stage 7, which holds the sample 6 and moves it along the XY plane. (Column 3 lines 67-68; Column 4 lines 1-13)

A device that sprays etching gas against the portion of the sample irradiated with the focused ion beam 5 comprises a nozzle 19 and a valve 20. The etching gas is supplied from a gas

Art Unit: 1753

supply 21 and is sprayed locally against the surface of the sample by the nozzle. The gas spray is turned on and off by the valve 20. Secondary charged particles 8 emanate from the surface of the sample 6 in response to the irradiation by beam 5. The particles 8 are detected by a secondary particle detector 9 which faces the surface of the sample 6. The output signal from the detector 9 is fed to an A/D converter 10 and then to an arithmetic circuit 15 which also receives a signal from the scanning control circuit 16. The signal from the detector 9 is synchronized with the signal from the scanning control circuit 16 to display the pattern on a display-processing unit 11. Blanking electrodes 12 are disposed along the irradiating ion beam to deflect the beam to a large extent in order to prevent the beam 5 from impinging on the sample 6. The blanking voltage applied between the blanking electrodes 12 is turned on and off by a blanking circuit 17. A scanning range-setting portion 18 acts to set the range in which the focused ion beam is scanned, for causing the beam 5 to impinge on a desired portion of a surface of the sample 6. The ion beam is controlled by one or both of the blanking circuit 17 and the scanning control circuit 16 within the range set by the scanning range-setting portion 18. (Column 4 lines 14-41)

The patterned film is modified in the manner described below. The sample 6 having a pattern to be modified is inserted into a chamber (not shown) the inside of which is maintained at a vacuum by a vacuum pump (not shown). The sample 6 comprises a substrate of glass or silicon on which a pattern is formed out of chromium, aluminum, or other material. (Column 4 lines 42-48)

Art Unit: 1753

Preferably beam 5 is formed by ions of Be, B, Si, In, Au, Cs, Sn or Bi, derived from a source in the liquid state. The most preferred ion material is Ga. (Column 5 lines 16-18)

A second example of the novel method of scanning the focused ion beam is next described by referring to FIG. 7, where the range 24 scanned by the focused ion beam apparatus for modification of the sample is similar to the range shown in FIG. 4. The beam is caused to impinge on the sample at spots a.sub.1, a.sub.2, . . . , a.sub.i-1, a.sub.i, . . . , a.sub.k, b.sub.1, b.sub.2, . . . , b.sub.i-1, b.sub.i, . . . , b.sub.k, c.sub.1, c.sub.2, . . . , c.sub.i-1, c.sub.i, . . . , c.sub.k, d.sub.1, d.sub.2, . . . , d.sub.i-1, d.sub.i, . . . , d.sub.k. In this second example, the beam is made to fall on the sample at spots a.sub.1, a.sub.2, . . . , a.sub.i-1, a.sub.i, . . . , a.sub.k, b.sub.1, b.sub.2, . . . , b.sub.i-1, b.sub.i, . . . , b.sub.k, c.sub.1, c.sub.2, . . . , c.sub.i-1, c.sub.i, . . . , c.sub.k, d.sub.1, d.sub.2, . . . , d.sub.i-1, d.sub.i, . . . , d.sub.k in that order thus completing one frame of irradiation. This pattern of irradiation is repeated to make the desired modification. In this method of scanning the focused ion beam, the scanning voltage applied between the scanning electrode 4 is controlled by the scanning control circuit 16. According to this method, a certain period of time elapses as the beam is deflected from one spot, e.g., d.sub.1, to a neighboring spot, e.g., b.sub.i, c.sub.1, c.sub.2, or b.sub.1. During this time, the density of the molecules of etching gas adhering to the surface of the sample 6 increases to a sufficiently high level. Also according to this method, two successively irradiated spots having no overlapping intensity distribution portions, unlike the case shown in FIG. 5. For this reason, the density of the etching gas molecules adhering to the surface of the sample 6 is always maintained at a sufficiently high level.

Art Unit: 1753

In other words, if the two successively irradiated spots are so spaced from each other than no overlap of intensity distribution is created between them, then the chemical reaction of the etching proceeds efficiently. The novel method of scanning the focused ion beam further reduces the total amount of etching gas which must be admitted into the apparatus in order to have a sufficient amount of etching gas adhere to the surface of the sample 6 by at least one order of magnitude as compared with the case where a patterned film is modified using etching gas together with the prior art method of scanning a focused ion beam. (Column 6 lines 33-58)

The sample can be either a photomask used for fabrication of ICs or an integrated circuit itself. Those portions of a pattern which should be removed can be removed rapidly. When the material forming the pattern is etched away by sputtering, it reacts with the etching gas and so it is not again deposited, unlike the case shown in FIG. 3. (Column 6 lines 59-65)

Claim Rejections - 35 USC § 103

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor

Art Unit: 1753

and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103© and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

12. Claims 13 and 16-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakagawa et al. (U.S. Pat. 4,874,460) in view of Casey, Jr. et al. (U.S. Pat. 6,042,738).

Nakagawa et al. is discussed above and all is as applies above. (See Nakagawa et al.)

The differences between Nakagawa et al. and the present claims is that the width of the boundary region is not discussed, the amount milled is not discussed, the material being chromium is not discussed, the substrate comprising quartz is not discussed and the etching gas comprising bromine is not discussed.

As to the width of the boundary region, Nakagawa teach etching an area as seen in Fig. 7. From Figure 7 depending on the number of iterations selected the width of the boundary region can be selected. (See Nakagawa et al. Figure 7)

As to the amount milled depending on the repeated irradiation one can selected the amount milled. (See Nakagawa et al. Column 6 lines 31-32)

Casey et al. teach focused ion beam milling a quartz substrate having a chromium film with a bromine gas. (See Abstract; Column 3 lines 53-56)

The motivation for etching with bromine is that it allows for removal of an excess portion. (Column 2 lines 29-32)

Art Unit: 1753

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Nakagawa et al. by utilizing an etching gas containing bromine to etch a quartz substrate with chromium film as taught by Casey et al. because it allows for removing an excess portion of a film.

Double Patenting

13. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321© may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Art Unit: 1753

14. Claims 1-11 and 13-19 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-18 of U.S. Patent No. 6,322,672 in view of Casey, Jr et al. (U.S. Pat. 6,042,738).

U.S. Pat. No. 6,322,672 teach a method of focused ion beam milling comprising directing the focused ion beam toward the copper in a first pattern, characterized by a first pixel spacing greater than the spot size characterizing the focused ion beam; directing the focused ion beam toward the copper in a second pattern characterized by a second pixel spacing, the second pixel spacing being less than the first pixel spacing and less than or approximately equal to the ion beam spot size, thereby producing a uniformly smooth floor of the milled area with substantially no remaining copper which is what the currently pending claims require.

The differences between U.S. Pat. 6,322,672 and the present claims is that chromium as the film is not discussed, bromine as the etching gas is not discussed and the substrate being quartz is not discussed.

Casey et al. teach focused ion beam milling a quartz substrate having a chromium film with a bromine gas. (See Abstract; Column 3 lines 53-56)

The motivation for etching with bromine is that it allows for removal of an excess portion. (Column 2 lines 29-32)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified U.S. Pat. 6,322,672 by utilizing an etching gas containing

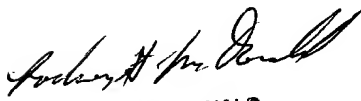
Art Unit: 1753

bromine to etch a quartz substrate with chromium film as taught by Casey et al. because it allows for removing an excess portion of a film.

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rodney McDonald whose telephone number is 703-308-3807. The examiner can normally be reached on M-Th from 8 to 5:30. The examiner can also be reached on alternate Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen, can be reached on (703) 308-3322. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9310.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.



RODNEY G. MCDONALD
PRIMARY EXAMINER

RM

February 12, 2003